



## Grain storage: Insect control

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### Fumigate for success

A fumigation procedure is a precise set of conditions, gas must be retained at a concentration for a required period of time (c x t product). This is to ensure all stages of the insect are eliminated. Grain insects pass through four life stages and the mobile adult and larvae are readily killed as they move around amongst the grain – the more difficult stages are immobile pupae and egg. The gas must be retained for sufficient time to allow them to mature to a more vulnerable stage. Figure 1 shows how during progress through life stages the insects can tolerate higher levels of phosphine.

In WA we recommend a gas concentration of 100 ppm held for a minimum of seven days in all parts of the silo.

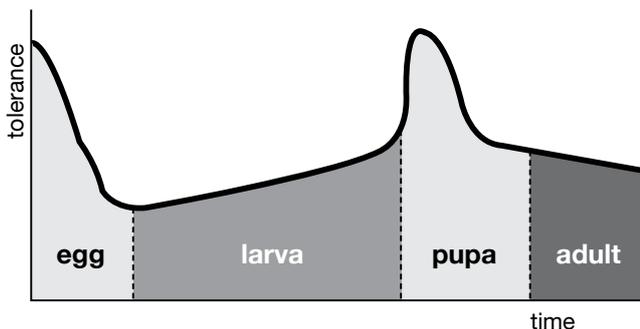


Figure 1 Grain insect tolerance to phosphine

If the gas is not retained there is a high probability that a low dose/short time fumigation will select insects that are able to tolerate low gas levels. In WA there is slow increase of insect samples exhibiting a weak resistance to phosphine (about 45% in 2008). In the eastern States there is a much higher level of weak resistance but an increasing number of samples are showing strong resistant characteristics.

Resistance to phosphine does not mean the insects cannot be controlled with phosphine it just means you have to ensure the structure in which you fumigate is able to hold the gas to achieve a c x t product.

For strong resistance this means 200 ppm for 9 days and trials conducted in WA have demonstrated this can be achieved in a well maintained sealed silo.

The aim is to ensure total elimination of all grain pests within the silo at the first fumigation.

### Get it right the first time

Grain in a well-maintained sealed silo may be protected indefinitely by adding two phosphine-generating tablets per tonne of silo capacity or use the 'Bagchain' formulation (powdered aluminium phosphide retained in joined porous pouches). Phosphine will not damage germination at this recommended rate. Provided the silo is sealed to the recommended standard and the correct dose is applied the recommended c x t product will be achieved.

Place the tablets in trays or Bagchain in the headspace of the silo and observe the correct fumigation period of at least seven days. (figure 2 and figure 3) (Refer to Farmnote 67/03 'Sealed silos make \$sense').



Figure 2 Phosphine tablets on tray to be placed in the headspace of the silo



Figure 3 Bagchain formulation of phosphine in headspace of silo

### Important Disclaimer

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Although a well-sealed silo will not allow insects to re-enter, it is wise to check the grain at regular intervals for insect infestation after fumigation. Pitfall traps installed in the peak of the grain enable insect detection long before they become visible in the grain. Phosphine leaves no detectable residue when applied correctly and treated grain may be delivered at the bin with no penalty but a declaration must be made.

It is illegal to transport grain under fumigation or to deliver grain with partly decomposed phosphine tablets.

## Emergency fumigation

Fumigation is most convenient and effective in a solid sealed structure. However, in the absence of such a grain store, a good fumigation can be carried out under a gas-proof tarpaulin. The aim of the procedure is to create a leak-proof envelope of plastic sheeting. Standard black 'builders' plastic sheeting is not gas-proof, is difficult to make leak-proof and is easily damaged. Heavy-duty gas-proof tarpaulins are recommended for the task. Lay a tarpaulin on the ground and heap the grain on top, cover with a gas-proof sheet and roll the edges together. Lock them together with soil or weights to prevent gas loss. Calculate the size of the heap and apply 1.5 grams of phosphine per cubic metre. Unroll a small section to allow the introduction of phosphine in a Bagchain or sachet formulation. If tablets are used on a tray, you must create 30 cm of airspace above the tray of tablets to avoid the development of explosive concentrations of gas. Allow 10 days for the gas to release and full circulation to occur. Open the rolled edges and let the remaining gas escape. Remove the tarpaulin and allow three days of ventilation before delivery. If the tarpaulin is large enough it may be possible to dump the grain in the middle and roll the edges together on top of the pile.

## Insecticide

Malathion is the only insecticide registered for application to grain by farmers in Western Australia. Malathion resistance among insects is widespread throughout the State and you should consider other control methods whenever possible. Malathion may protect your grain for 3–6 months where insects are still susceptible. Spray the label recommended mix onto the grain at the rate of 1 L per tonne as it is augured into the silo. Alternatively, add Malathion dust at 1 kg per tonne. Increasing the dose rate will not significantly increase protection. Malathion will break down in 3–6 months under ideal (cool, dry) conditions.

The use of other insecticides for protecting grain is illegal in Western Australia.

## Dryacide®

The treatment of grain with Dryacide® dust at 1 kg per tonne will give protection for at least one year, and sometimes more. In all cases the grain must be dry (no more than 12 per cent moisture) and the Dryacide® must be thoroughly incorporated, preferably using a mechanical applicator.

Dryacide® should not be used on dusty grain or if insects are already active in the grain. This is because Dryacide® is a protectant and does not kill a large population of insects quickly.

Dryacide® treated grain may be stored in unsealed silos or in any convenient place. It is the best treatment for grain stored in old silos which are difficult or expensive to seal. The cost of treating grain with Dryacide® is much greater than fumigation in sealed silos but enables the use of existing silos without incurring the cost of retro-sealing.

Dryacide® treated grain is safe to feed to both humans and animals but it cannot be delivered to CBH because of dust and the changed flow characteristics of treated grain. If sowing Dryacide® treated seed, remember to recalibrate the seeder. A machine set for untreated grain can sow 10–15 per cent less grain with Dryacide®.

## Dryacide® and moisture migration

To be effective, Dryacide® must be applied evenly throughout the grain with a mechanical applicator. If it is not mixed thoroughly, isolated pockets of weevils may survive. Moisture and heat liberated by these insects as they feed may migrate to surrounding areas and ultimately into the headspace. In a poorly maintained silo that has been factory sealed but is no longer airtight, it is difficult for moisture to vent to the atmosphere so the upper levels of grain may rise above 12 per cent moisture content. Above this moisture content, Dryacide® continues to absorb the wax coating from the cuticle of the insect but the weevils will not dehydrate in a moist environment.

**Note:** Mention of trade names does not imply endorsement or preference of any company's product by the Department of Agriculture and Food, and any omission of a trade name is unintentional. Recommendations were current at the time of preparation of this publication.

## Further reading

- Farmnote 24/02 Aeration: for preserving grain quality
- Farmnote 64/03 Grain storage: Design and installation
- Farmnote 66/03 Grain storage: Handling and maintenance
- Farmnote 302 Grain storage: Maintaining grain quality
- Farmnote 67/03 Sealed silos make \$ense
- Farmnote 68/03 It makes \$ense to maintain your sealed silo
- Farmnote 69/03 Effective fumigation needs a properly sealed silo
- Farmnote 70/03 Stored grain management: underground storage of grain